

CLAIMS

What is claimed is:

1. A method for fabricating a steel article, comprising the steps of providing an iron-base alloy having less than about 0.5 weight percent aluminum; thereafter

melting the alloy to form a melt; thereafter

5 adding a first calcium addition to the melt; thereafter

adding aluminum to the melt to increase the aluminum content of the melt to more than about 0.5 weight percent aluminum; and thereafter

casting the melt to form a casting.

2. The method of claim 1, wherein the step of providing the iron-base alloy includes the step of

providing the iron-base alloy having less than about 0.1 weight percent aluminum.

3. The method of claim 1, wherein the step of providing the iron-base alloy includes the step of

providing the iron-base alloy having from about 10 to about 18 weight percent nickel, from about 8 to about 16 weight percent cobalt, from about 1 to 5 about 5 weight percent molybdenum, less than about 0.5 weight percent aluminum, and from about 1 to about 3 weight percent chromium.

4. The method of claim 1, wherein the step of melting the alloy includes the step of

melting the alloy in a vacuum furnace.

5. The method of claim 1, including an additional step, performed concurrently with the step of melting the alloy and before the step of adding the first calcium addition to the melt, of

5 reducing the oxygen content of the melt to less than about 10 parts per million by weight.

6. The method of claim 1, wherein the step of adding the first calcium addition to the melt includes the step of
adding the first calcium addition in an amount of more than about 200 parts per million by weight.

7. The method of claim 1, wherein the step of adding aluminum includes the step of
adding sufficient aluminum to increase the aluminum content of the melt to from about 0.5 to about 1.3 weight percent aluminum.

8. The method of claim 1, including an additional step, performed concurrently with the step of adding aluminum, of
adding a second calcium addition to the melt.

9. The method of claim 1, including an additional step, performed concurrently with the step of adding aluminum, of
adding a second calcium addition to the melt in an amount of from about 100 to about 200 parts per million by weight.

10. The method of claim 1, including an additional step, after the step of adding aluminum and before the step of casting, of
adding a third calcium addition to the melt.

11. The method of claim 1, including an additional step, after the step of adding aluminum and before the step of casting, of
adding a third calcium addition to the melt in an amount of from about 50 to about 150 parts per million by weight.

12. The method of claim 1, wherein the step of casting the melt to form

a casting includes the step of

casting the melt to form the casting having a composition of from about 10 to about 18 weight percent nickel, from about 8 to about 16 weight percent cobalt, 5 from about 1 to about 5 weight percent molybdenum, from about 0.5 to about 1.3 weight percent aluminum, from about 1 to about 3 weight percent chromium, up to about 0.3 weight percent carbon, less than about 0.1 weight percent titanium, balance iron and impurities.

13. The method of claim 1, including an additional step, after the step of casting, of

mechanically working the casting.

14. The method of claim 1, including an additional step, after the step of casting, of

mechanically working the casting to form a shaft.

15. A method for fabricating a steel article, comprising the steps of providing an iron-base alloy having more than about 0.3 weight percent carbon and less than about 0.1 weight percent aluminum; thereafter

melting the alloy in a vacuum furnace to form a melt, the step of melting 5 the alloy including the step of

gradually reducing the pressure within the vacuum furnace to induce a carbon boil in the melt which reduces the oxygen content of the melt to less than about 10 parts per million by weight; thereafter

adding a first addition of calcium to the melt in an amount of more than 10 about 200 parts per million by weight; thereafter
simultaneously

adding aluminum to the melt to increase the aluminum content of the melt to more than about 0.5 weight percent aluminum, and

adding a second calcium addition to the melt in an amount of from 15 about 50 to about 150 parts per million by weight; thereafter
adding a third calcium addition to the melt; thereafter

casting the melt to form a casting; and thereafter mechanically working the casting.

16. The method of claim 15, wherein the step of adding aluminum includes the step of

adding sufficient aluminum to increase the aluminum content of the melt to from about 0.5 to about 1.3 weight percent aluminum.

17. The method of claim 15, wherein the step of casting the melt to form a casting includes the step of

casting the melt to form the casting having a composition of from about 10 to about 18 weight percent nickel, from about 8 to about 16 weight percent cobalt, 5 from about 1 to about 5 weight percent molybdenum, from about 0.5 to about 1.3 weight percent aluminum, from about 1 to about 3 weight percent chromium, up to about 0.3 weight percent carbon, less than about 0.1 weight percent titanium, balance iron and impurities.

18. The method of claim 15, wherein the step of mechanically working the casting includes the step of

mechanically working the casting to form a shaft.

19. A method for fabricating a steel article, comprising the steps of melting an iron-base alloy having less than about 0.5 weight percent aluminum while reducing the oxygen content of the melt to less than about 10 parts per million by weight, the step of reducing the oxygen content including the 5 step of

adding a deoxidizer to the melt;

adding aluminum to the melt to increase the aluminum content of the melt to more than about 0.5 weight percent aluminum; and thereafter casting the melt to form a casting.

20. The method of claim 19, wherein the step of melting the iron-base

alloy includes the step of

providing the melt having less than about 0.1 weight percent aluminum and more than about 0.3 weight percent carbon.

21. The method of claim 19, wherein the step of adding the deoxidizer includes the step of
adding calcium to the melt.